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Liquid Chromatography- Tandem Mass Spectrometry (LC-MS-MS) as a detection method for Cocaine as a Perfomance Enhancing Drug

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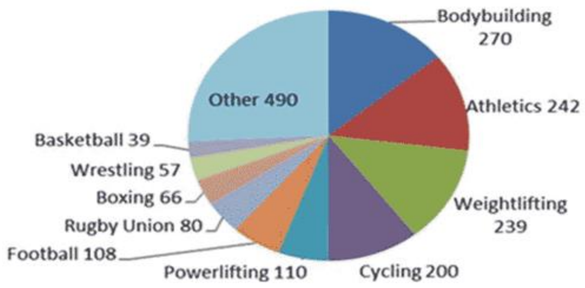
INTRODUCTION

In competitive sports, doping is the use of banned athletic performance-enhancing drugs by athletic competitors.
Among the most popular PEDs are anabolic steroids, human growth hormone, erythropoietin (EPO), beta-blockers, stimulants and diuretics.



Sports with the greatest numbers of anti-doping rules violations in 2015.

World Anti-Doping Authority (WADA) : It works to coordinate the fight against doping in sport internationally

WADA prevents the use of Performance enhancing drugs because: 1) it is or potentially is harmful to the athlete's health, and 2) it violates the spirit of sport.

WADA has published an annual List of Prohibited Substances and Methods

Analytical techniques look at not only banned substances but metabolites

Samples that can be tested include blood, saliva and urine, with a wide range of techniques being used: GC-MS, LC-MS, LC-MS-MS, Biomarker tests, Isoform Differential Immunoassay Tests, RNA Testing, GC/C/IRMS, Flow Cytometry, Isoelectric Focusing.

METHOD

Liquid Chromatography - Tandem Mass Spectrometry (LC-MS-MS)

It is a powerful analytical technique that combines the separating power of liquid chromatography with the highly sensitive and selective mass analysis capability of triple quadrupole mass spectrometry.

ADVANTAGES

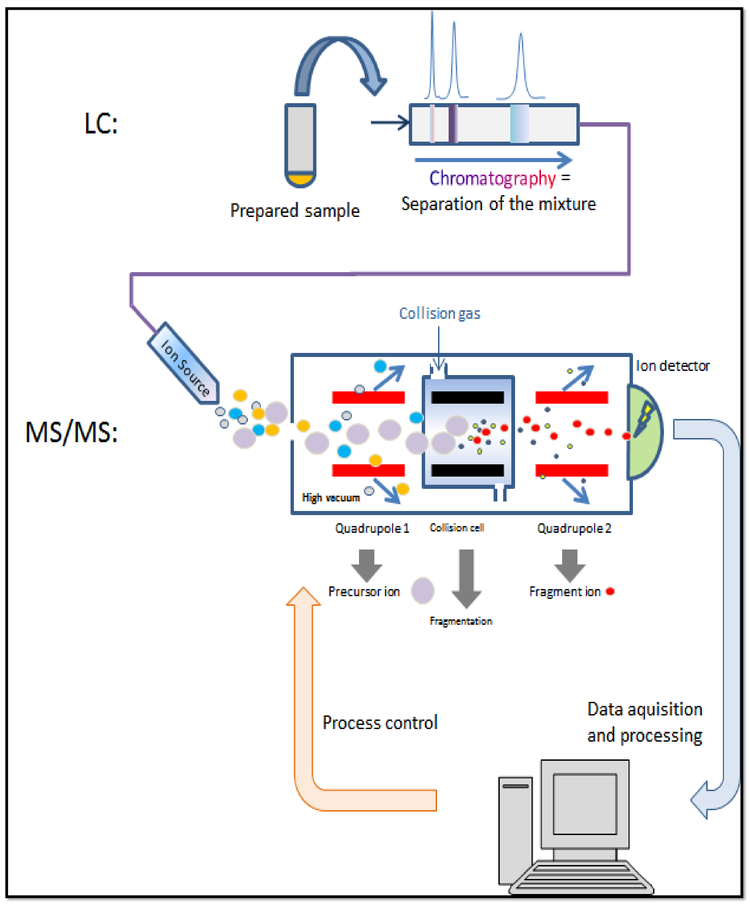
- ✓ Quicker and less extensive extraction procedures
- ✓ Simultaneous multianalyte method.
- ✓ Highly selective, specific and gives accurate results within a short span of time
- ✓ Better sensitivity than GC.
- ✓ No derivatization needed.

DISADVANTAGES

- ✓ Expensive.
- ✓ Not portable.
- ✓ Experienced Technicians required.

INSTRUMENTATION

- MS-MS is the combination of two mass analyzer in one mass spectra instrument.
- The first mass filters for precursor ion followed by a fragmentation of the precursor ion with high energy and example is nitrogen gas.
- A second mass analyzer is then filtering the product ions, generated by the fragmentation. This is usually done in a triple quadrapole MS(QQQ) or a(QTOF).



MASS SPECTROMETRY OF COCAINE

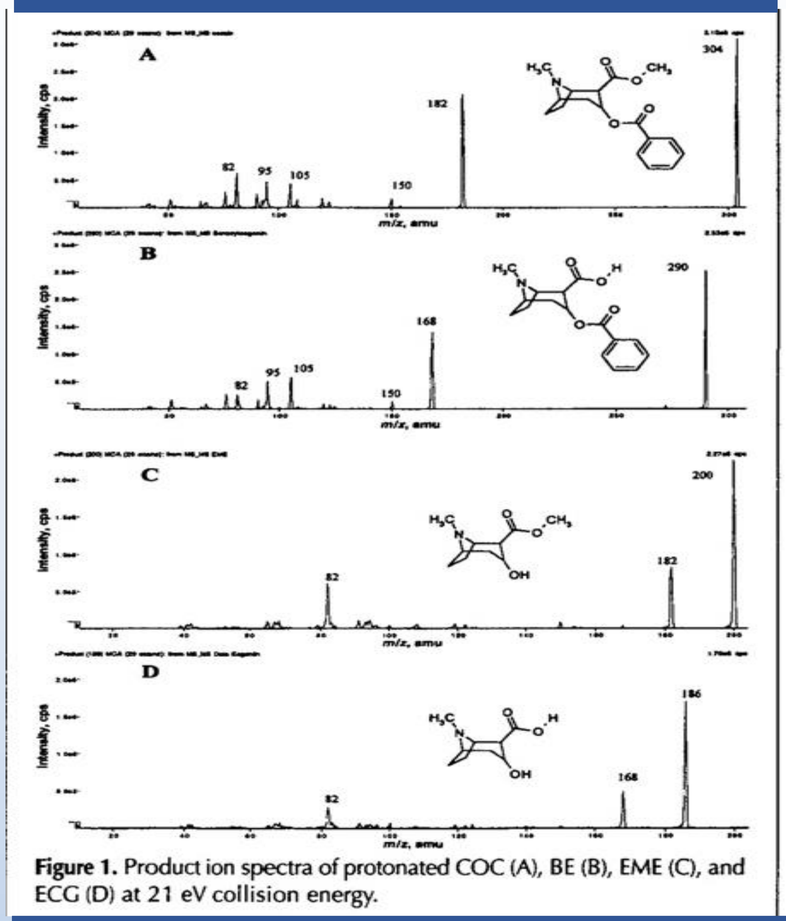


Figure 1. Product ion spectra of protonated COC (A), BE (B), EME (C), and ECG (D) at 21 eV collision energy.

COCAINE

Benzoylecgonine (BZE), a demethylation product of cocaine (COC) and the major metabolite found in humans, does not exhibit any pharmacological activity. It has wide toxicological interest however, due to its long half-life, and remains detectable in biological fluids considerably longer than COC.
Major Metabolites of Cocaine:
Eenzoylecgonine (BE)
Ecgonine methyl ester (EME)
Egconidine

CONCLUSION

LC- MS-MS is one of the best techniques to find out the concentration of cocaine from samples. The peaks obtained from the Mass Spectrometer helps in determining that the compound that we are detecting is present in the sample.

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